

## Solutions at a Glance: DENMARK: A SUCCESS STORY IN WIND DEVELOPMENT

*By Jim Duncan, Sparling*



The Middelgrunden wind project, with 20 2-MW turbines, is constructed in shallow waters off the coastline of Copenhagen. (Photo by Jim Mueller, GBS Real Estate)

Copenhagen is a city built for humans, and is not just one of the world's great design capitals but one of Europe's most forward-thinking cities. It's a city that boasts cobbled squares, canals, a rich portfolio of world class museums, many open-air cafes, and a pace of life that is dictated more by pedestrians than cars. Looking across the city between an impressive collection of architecture, with exquisite 16th, 17th and 18th century copper spired buildings there is a sweeping arc of 20 windmills in the harbor. These are not the traditional Danish windmills of

childhood stories used to mill corn or pump water. This is a modern wind farm that is producing electrical power. That crisp, clean Scandinavian air that refreshes you and blows through the bricked narrow and winding streets is also generating electrical energy.

Denmark is an amazing success story when it comes to becoming energy independent. During the oil crisis of the 1970's, Denmark was dependent on foreign oil for 98 percent of its energy needs. In response, Denmark committed itself to energy independence, in

part through the development of renewable energy technologies and energy efficiency. Today Denmark is a net exporter of energy and renewable energy technology, and the world's leading manufacturer of wind turbine technology

While Denmark began its harvesting of wind power in the 1980's, Washington's first wind project did not come on-line until 2001. Denmark is about 25 percent the size of Washington State, and currently has 3,115 MW of installed wind power, whereas Washington State has only 244 MW. Yet according to the Renewable Energy Atlas of the West, Washington has economically viable potential for about 62 M MWh per year, which represents about 7,100 MW of installed capacity. Why then, one wonders, is Denmark so far ahead of us?

Let's see what we can learn from Denmark's experience with wind, including some lessons which are now being set in motion in the Northwest. From community-owned wind cooperatives to producing more wind equipment than all other nations combined, the success of this and other renewable energies is due in part

to a commitment to determine the most beneficial solution for the most people.

### **Mitigating Community Concern**

A critical deterrent to installing wind turbines is opposition from residents near proposed sites. The large size of turbines, noise, and their effect on wildlife can be legitimate barriers to a project's approval. U.S. wind farms are typically owned and developed by utilities or large, private developers who can be perceived as "outsiders" trying to exploit local resources.

Denmark cleverly avoided this situation by promoting wind turbine ownership by cooperatives, and even requiring members/owners to live within a certain distance of the site. At one time, nearly 100,000 Danish families owned wind turbines or shares in wind cooperatives. These co-ops are now organized as the Danish Wind Turbine Owners Association.

On the sustainability tour, we were inspired by the Middelgrunden wind farm in the Copenhagen harbor, which is 50 percent owned and financed by a wind co-op of 8,300 members and 50 percent owned by the local utility. This wind farm is located just 1 to 2 miles off the Copenhagen waterfront, and consists of 20 wind turbines at 2 MW each. During planning, members of the co-op met with interest groups to generate a widespread understanding and acceptance for the site's location and layout. As a result, a number

of people opposed to the project changed their attitude and embraced wind energy.

While development trends have since superseded the critical role of the cooperatives, they did three things to improve and develop wind turbine technology. In years past, a co-op membership magazine published a list of all Danish turbines, what each turbine produced in a given month, and any technical problems that occurred. This established accountability and had a positive effect on development. It reinforced the importance of appropriate siting. It also established credibility of wind power and exposed myths about unreliability and high cost of the technology.

The co-op concept is starting to take place in the Northwest with the Klickitat County Community Wind Project, the first of its kind in Washington State. As a result of U.S. Department of Agriculture funding, Washington-based Last Mile Electric Cooperative and Klickitat County Public Utility District, along with partner Northwest Sustainable Energy for Economic Development, will develop a 300 kW community-owned wind project near Goldendale. This project will not only produce "clean energy", it will also be a model for recycling and re-powering former energy sites.

### **Lessons Learned**

There are several other lessons we can learn from wind energy production in Denmark:

### ***Get wind power out of R&D and into the mainstream.***

Denmark has been gaining real world experience with wind energy for over twenty years, and has gained invaluable expertise in how to build the necessary equipment and successfully integrate large amounts of wind into their energy systems. This is starting to happen in Washington State as utilities are looking more seriously at wind power due to growing demands for power. Both the Seattle City Light and Puget Sound Energy recently secured a wind-power program that ensures wind-generated energy through 2020, which is a step in the right direction.

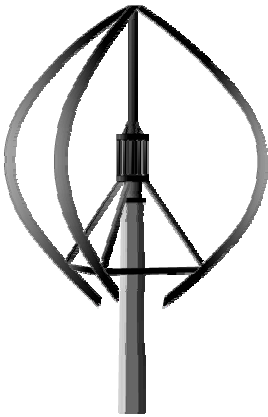


The Stateline wind project, on the border between Washington and Oregon, was when constructed one of the largest wind farms in the world. (Photo courtesy of Renewable Northwest Project)

### ***Utility company concerns.***

Some utility engineers are concerned that if too much generation comes from wind energy, it will cause system instability or even shutdowns. In

portions of Denmark's utility grid, 21 percent of the electricity is now generated from wind, which demonstrates successful integration of wind with other power generation sources. In the NW the marriage of wind and hydro is perfect since the generation of hydro power can be turned off when there is strong wind generation. One challenge in the Northwest is simply that our region has insufficient capacity to transfer electricity from areas of good wind resource to the load centers. There is currently over 3,000 MW of potential wind projects that are awaiting information on whether there is sufficient capacity for them to connect to the grid.



New, vertically oriented wind turbine designs may be better suited for urban settings. (Photo courtesy of Windstor)

**Wind may be successful in an urban environment.** The Middelgrunden project shows that siting wind farms in an urban area can be both functionally and aesthetically viable. Typically, cities are not located within the best wind resources because people do not like to live where it's windy! However, the Danish experience has shown us that wind generation could be an

option in some urban areas. Western Washington is not considered to have a high wind resource, but even here there may be small pockets where, because of the topography or the effects of man-made structures, a better resource is available. Examples include shorelines, on the top of tall urban structures, or places where the wind is funneled into a narrow passage. By locating wind generation near the load (ie, in an urban area) the costs of transmission are greatly reduced or eliminated, mitigating some of the economic challenges of the smaller wind resource.

***Make decisions based on what will benefit the most people.***

Many people who participated in the sustainability tours will agree that this is the most important lesson learned. People will support an investment that improves our environment and creates jobs, which has been the experience with wind energy in Denmark. Historically, considering the greater good and thinking long term about renewable energy options will benefit the most people. This is why Denmark instituted the consistent, long term energy policies that were essential for maximizing their own locally produced energy, and creating what is now their largest export industry.

It's time for Washington State to embrace wind energy as well. We need to build broad political and grassroots support for an investment that is perfect for Washington State. As coal prices rise and natural gas prices continue to demonstrate

volatility, utilities are seeing wind power as an attractive way to diversify their supply portfolio. Once a wind plant is built, it requires no fuel and produces no harmful emissions. In addition, the more wind we install, the more we conserve our limited natural resources. It's about conserving the earth's resources for the future. Now is the time to invest in wind energy.

**The Urban Sustainability Study Groups to Sweden and Denmark**

*International Sustainable Solutions facilitates the sharing of knowledge and the creation of market opportunities for sustainable practices and products. In 2004, International Sustainable Solutions ([www.i-sustain.com](http://www.i-sustain.com)) brought several groups of architects, engineers, developers and others from the Pacific Northwest to Scandinavia to look at advanced urban sustainability projects.*

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